

Figure 1

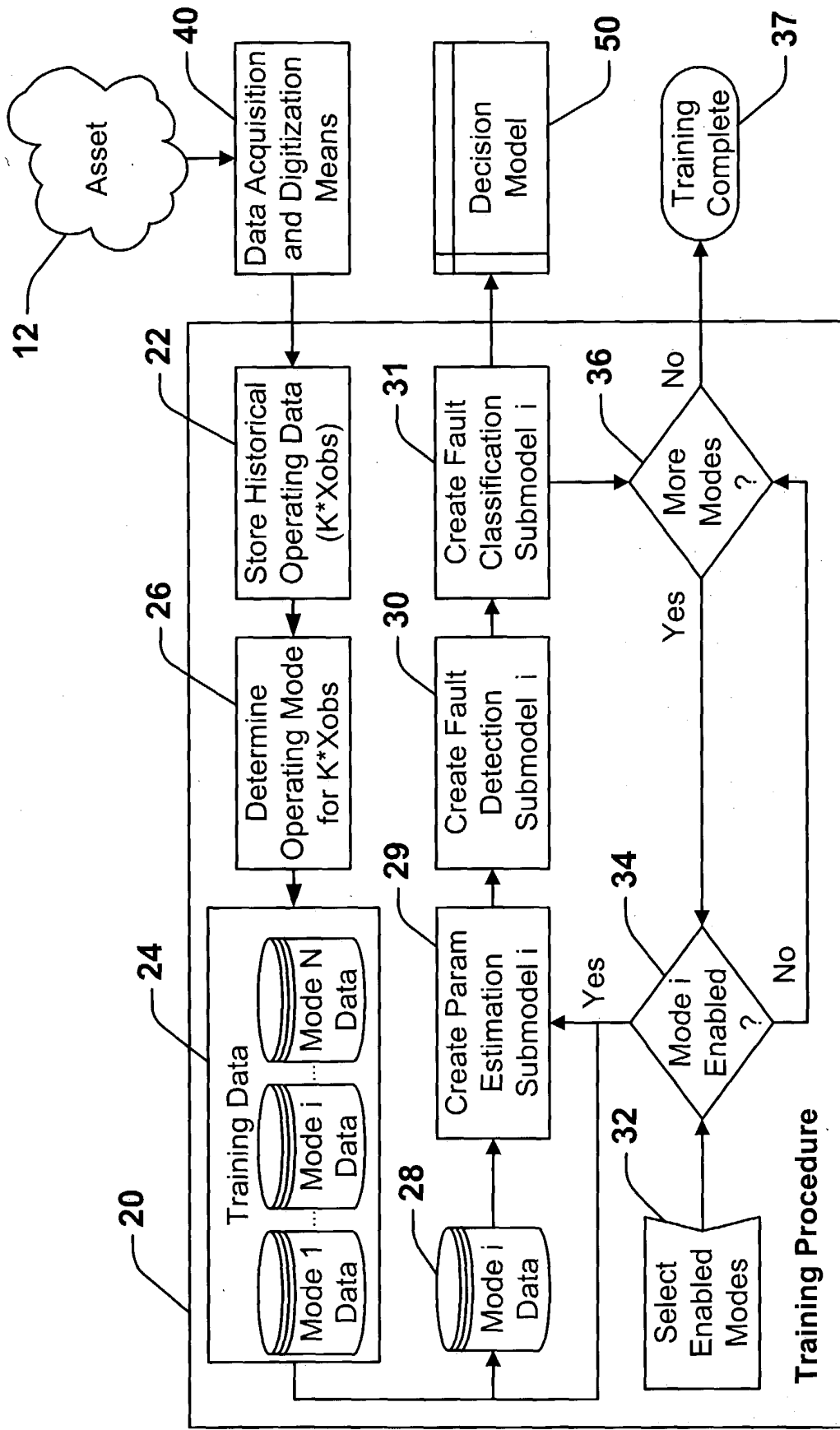


Figure 2

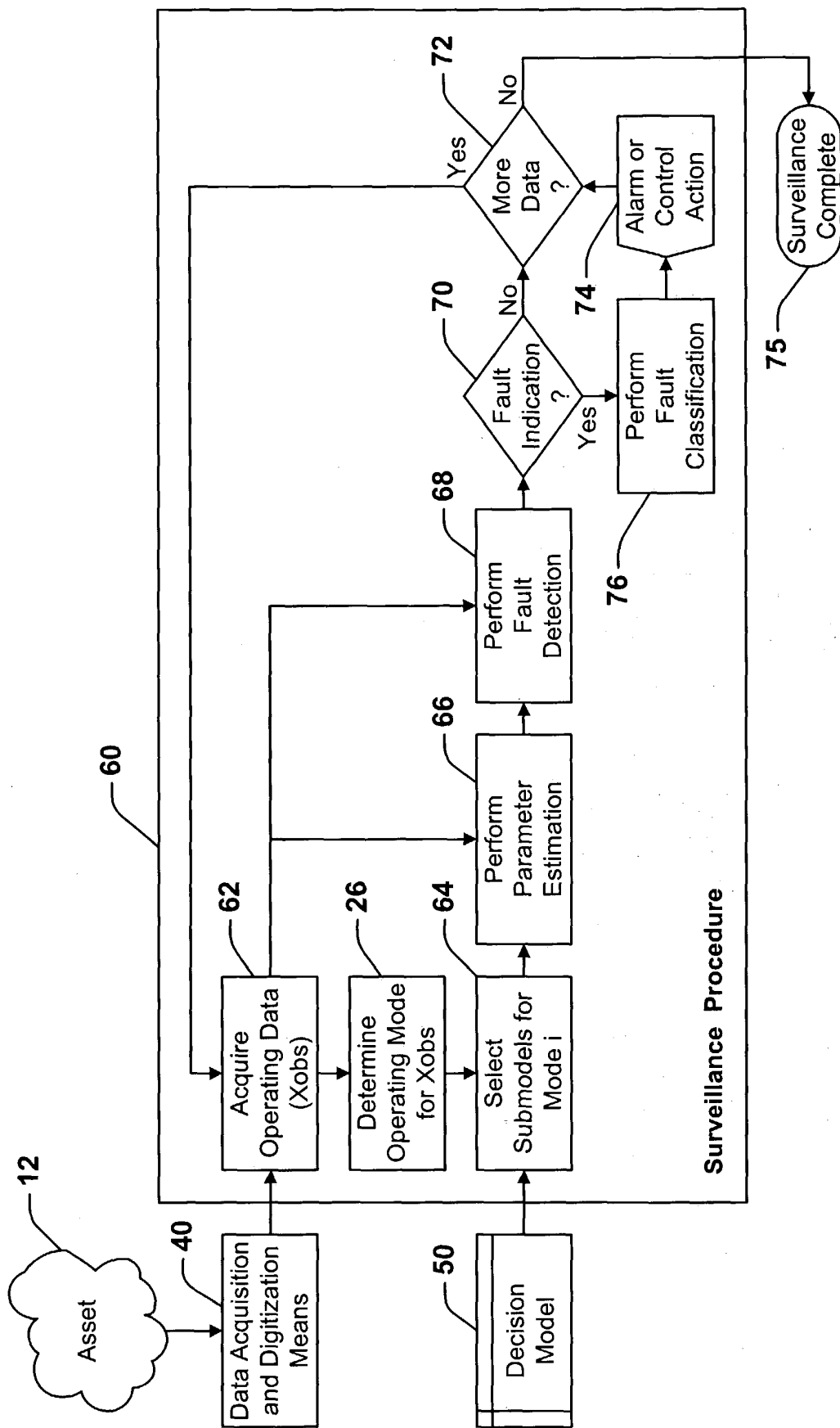


Figure 3

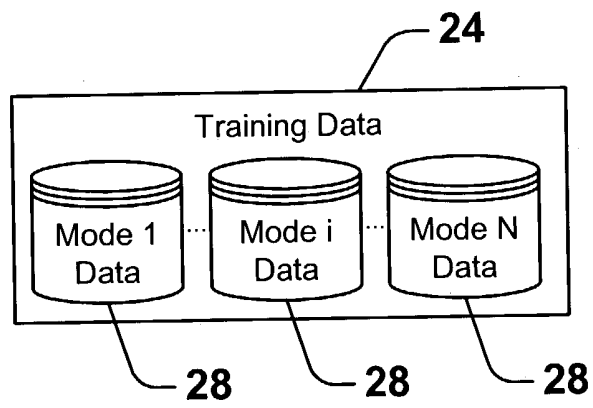


Figure 4

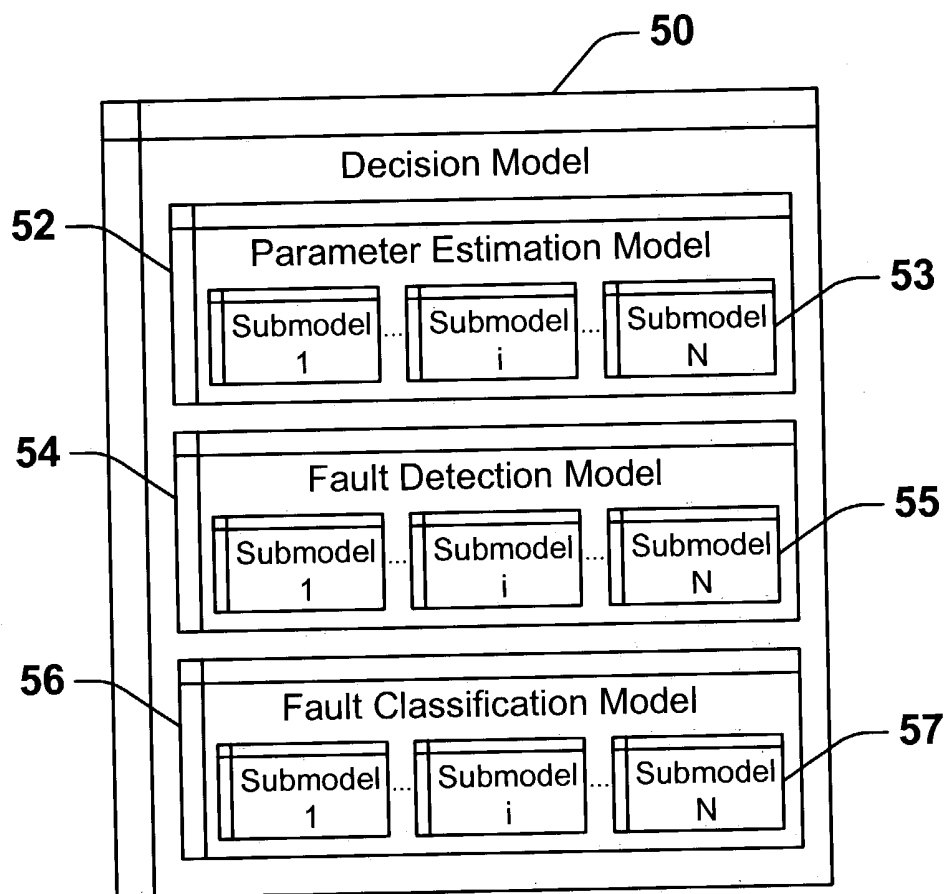


Figure 5

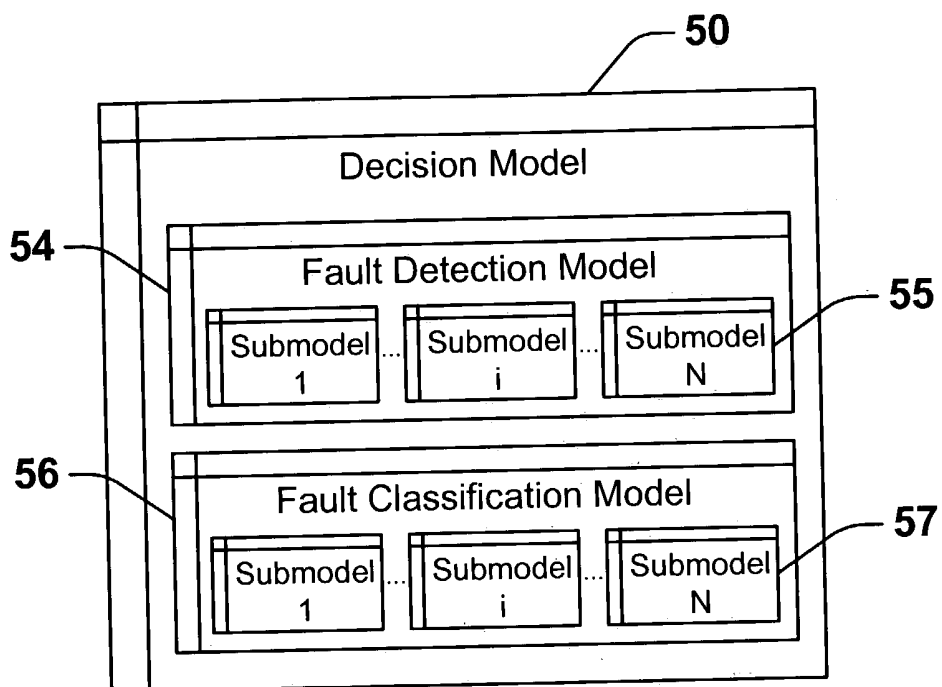


Figure 6

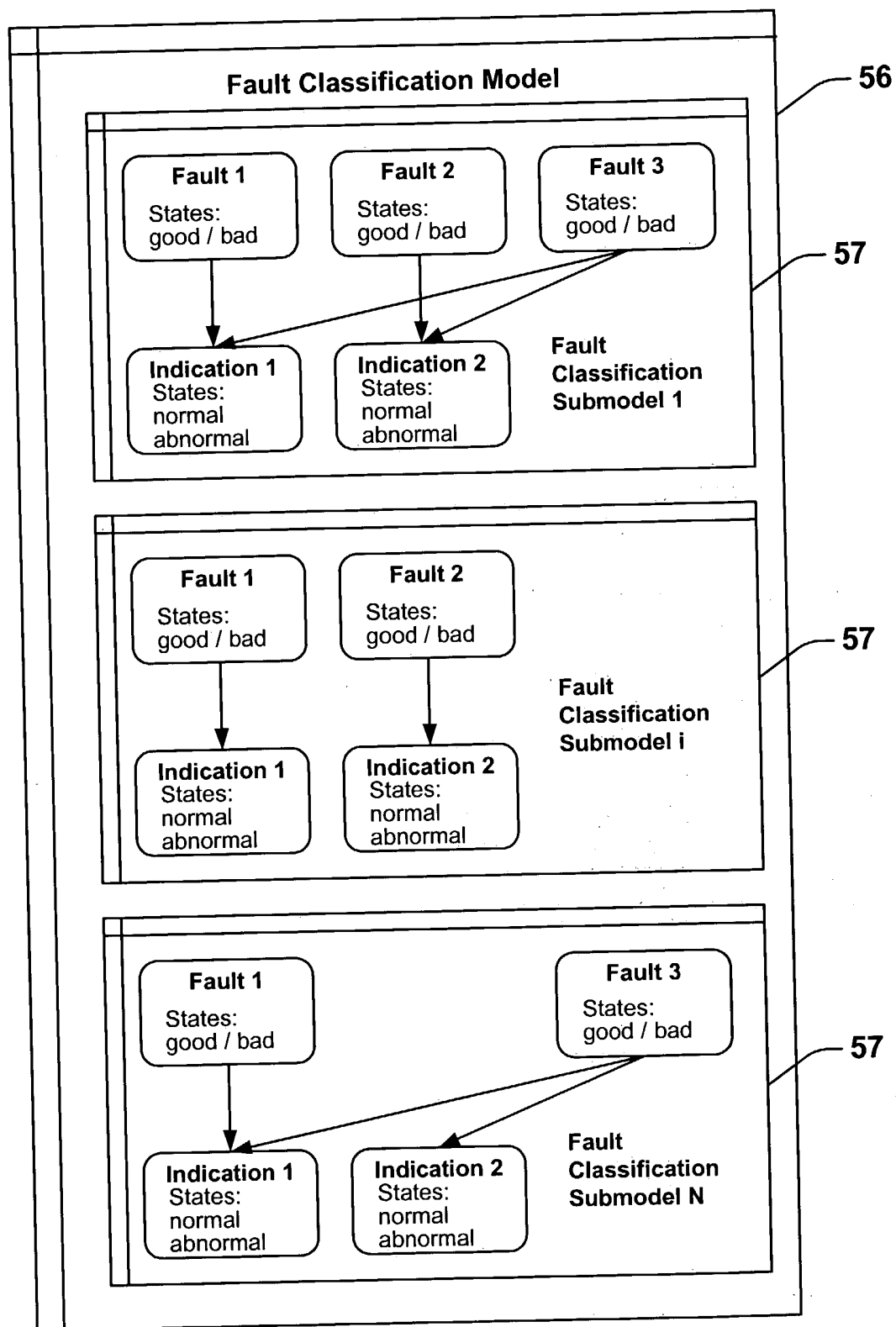


Figure 7

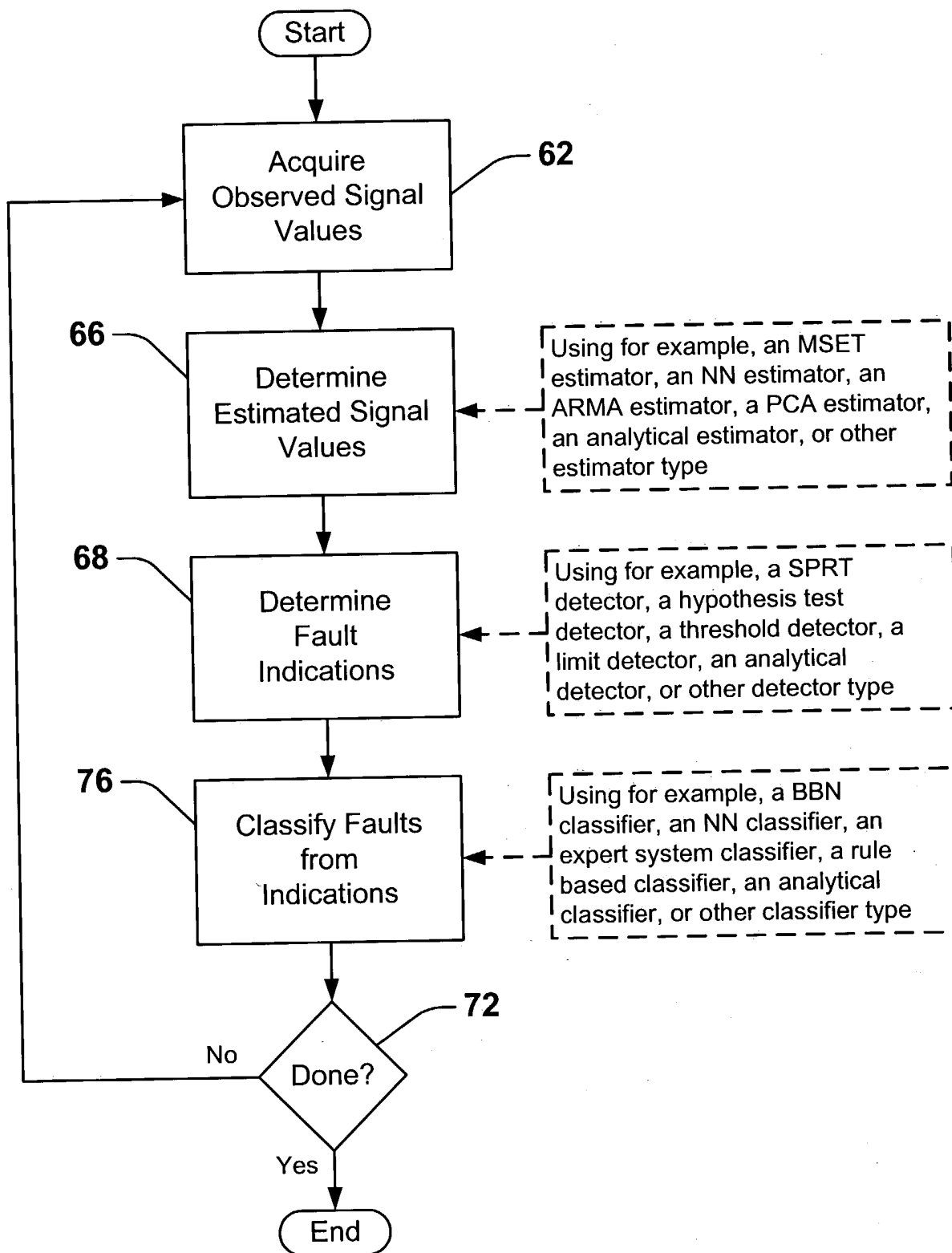


Figure 8

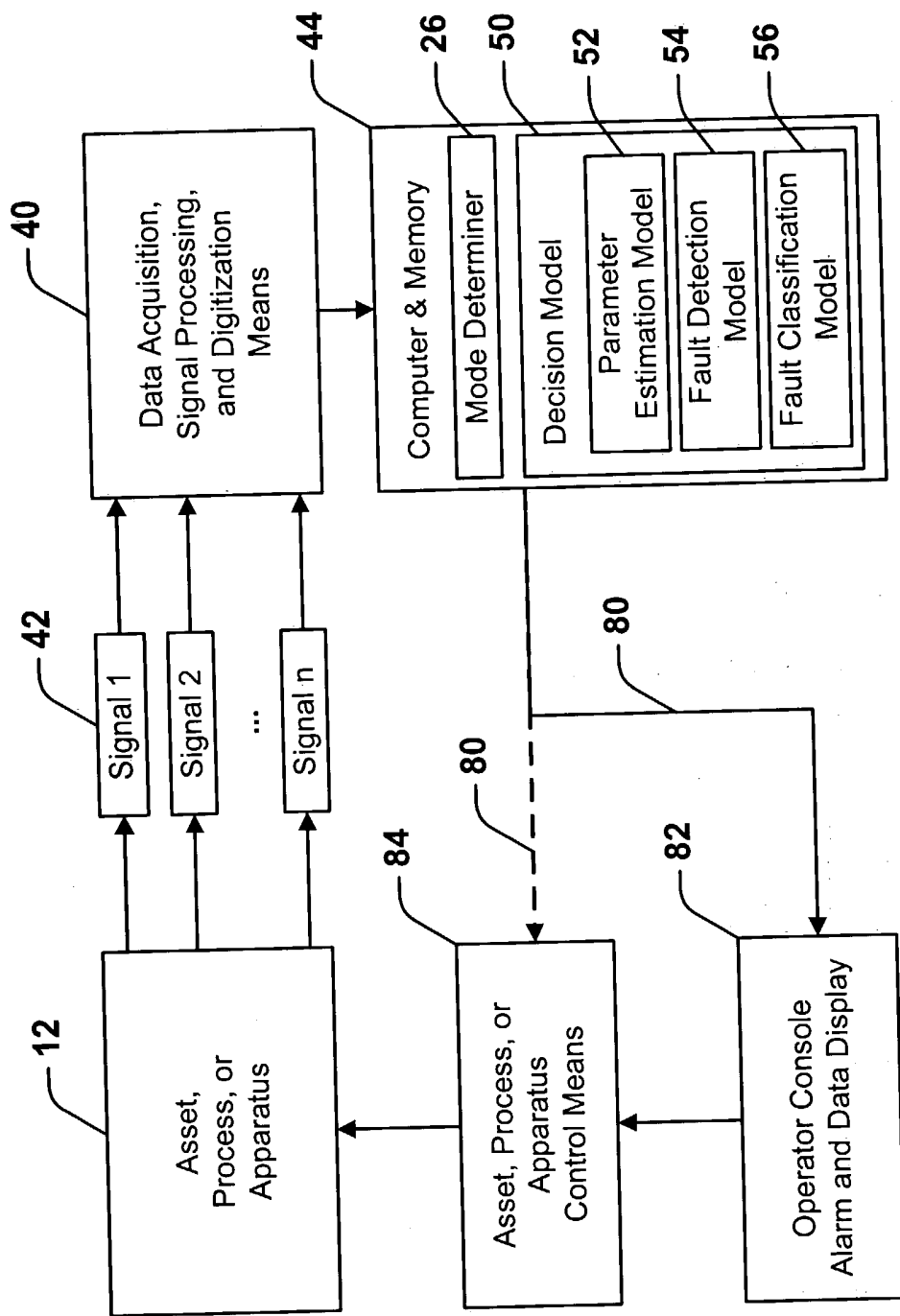


Figure 9

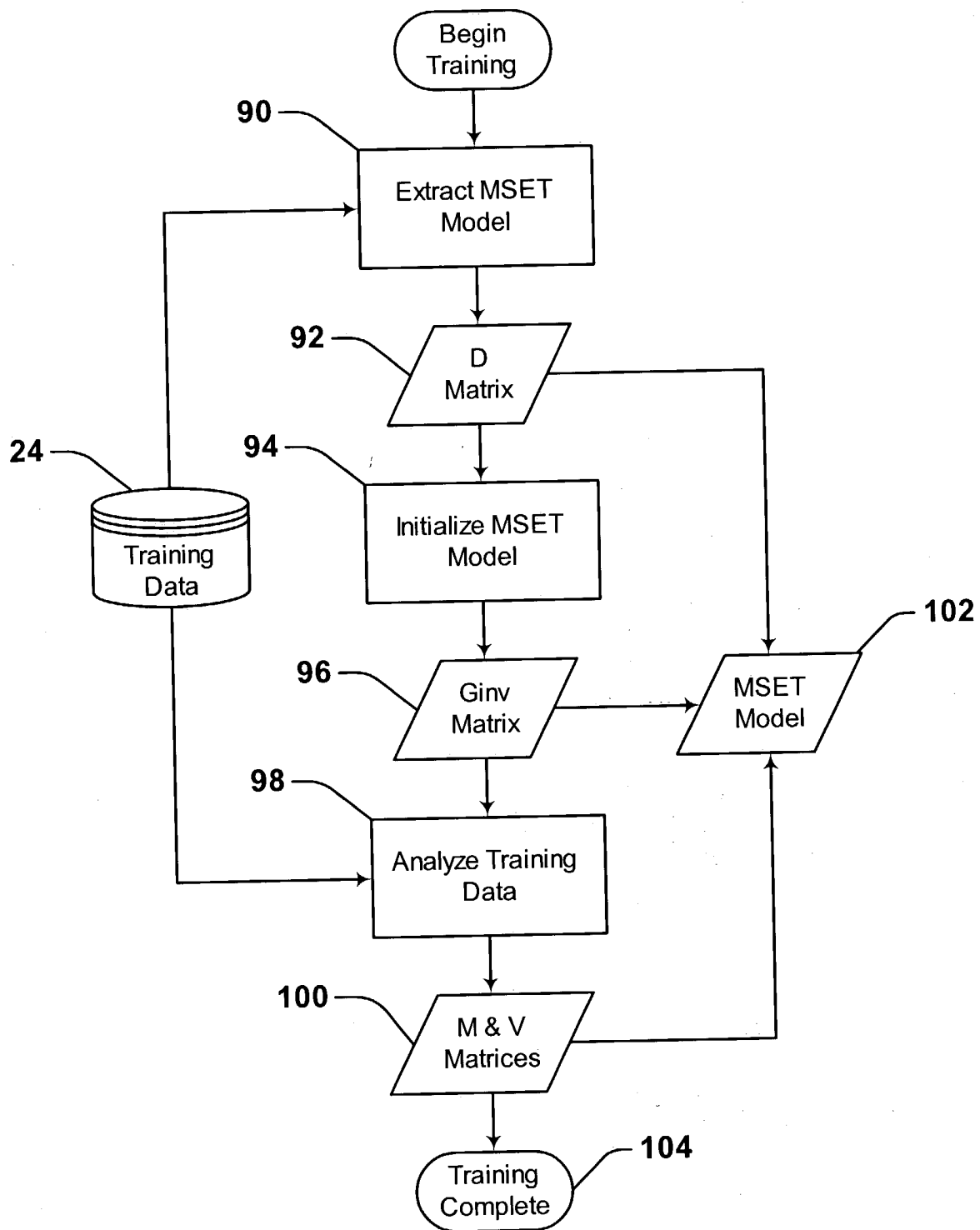


Figure 10

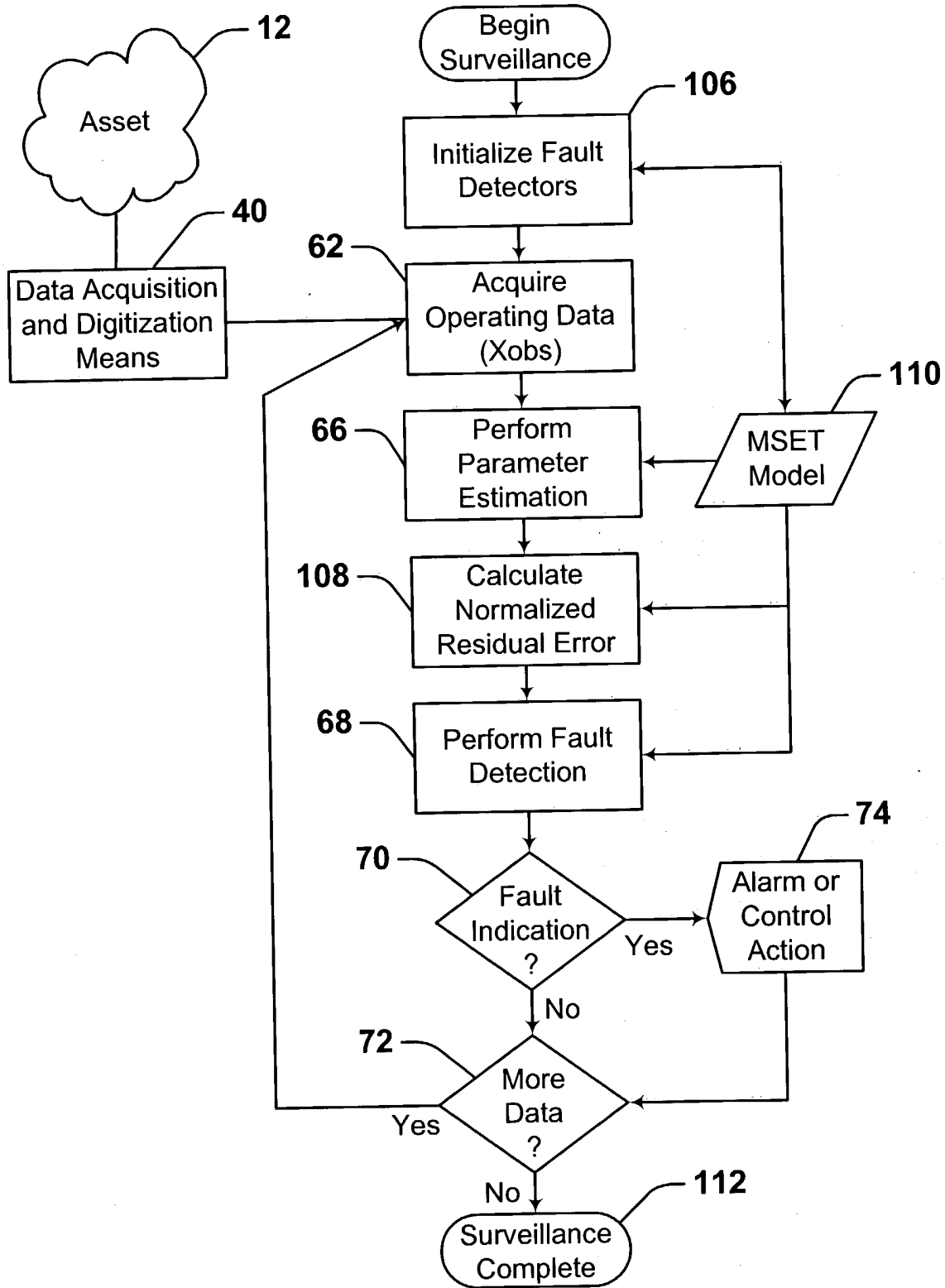


Figure 11

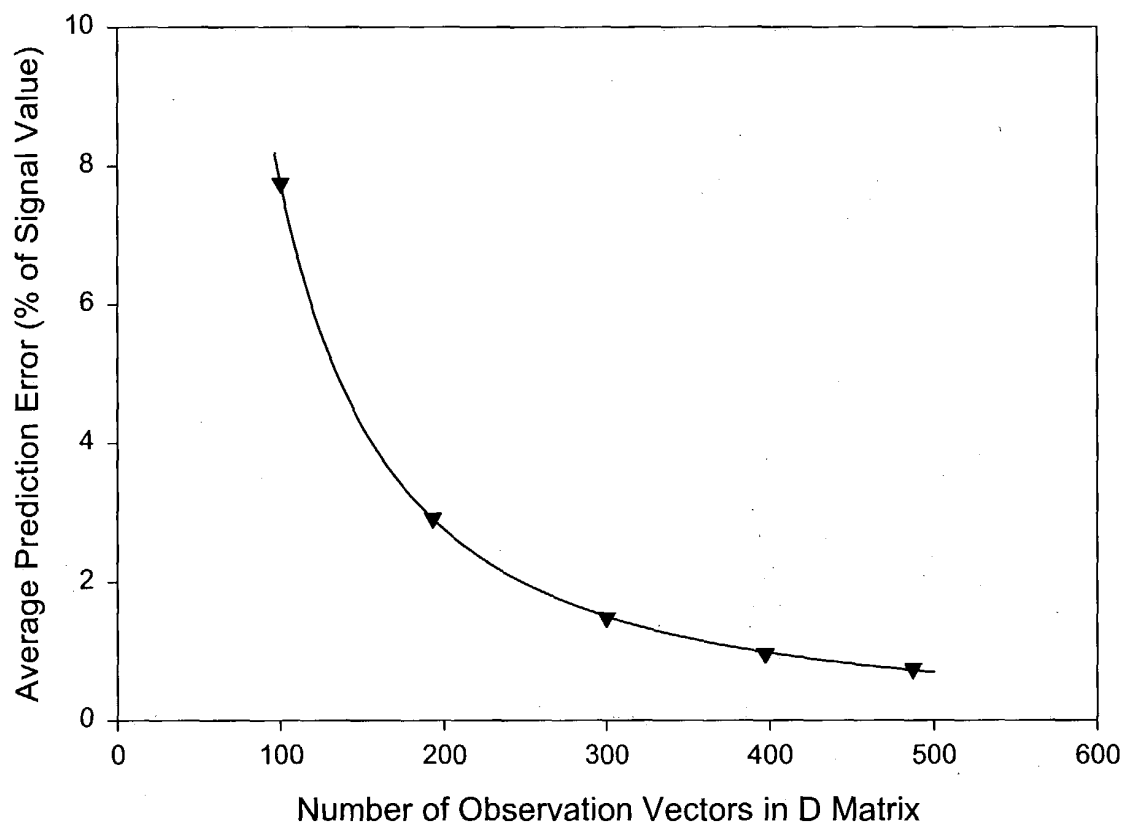


Figure 12

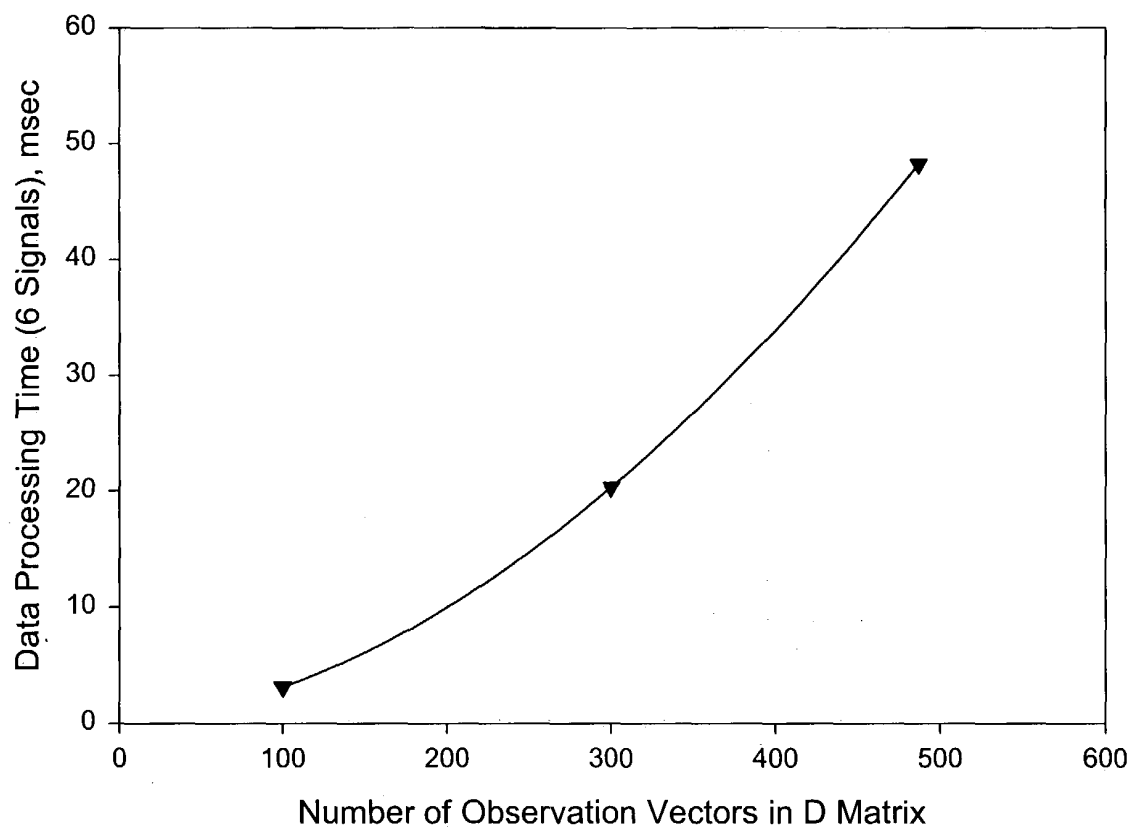


Figure 13

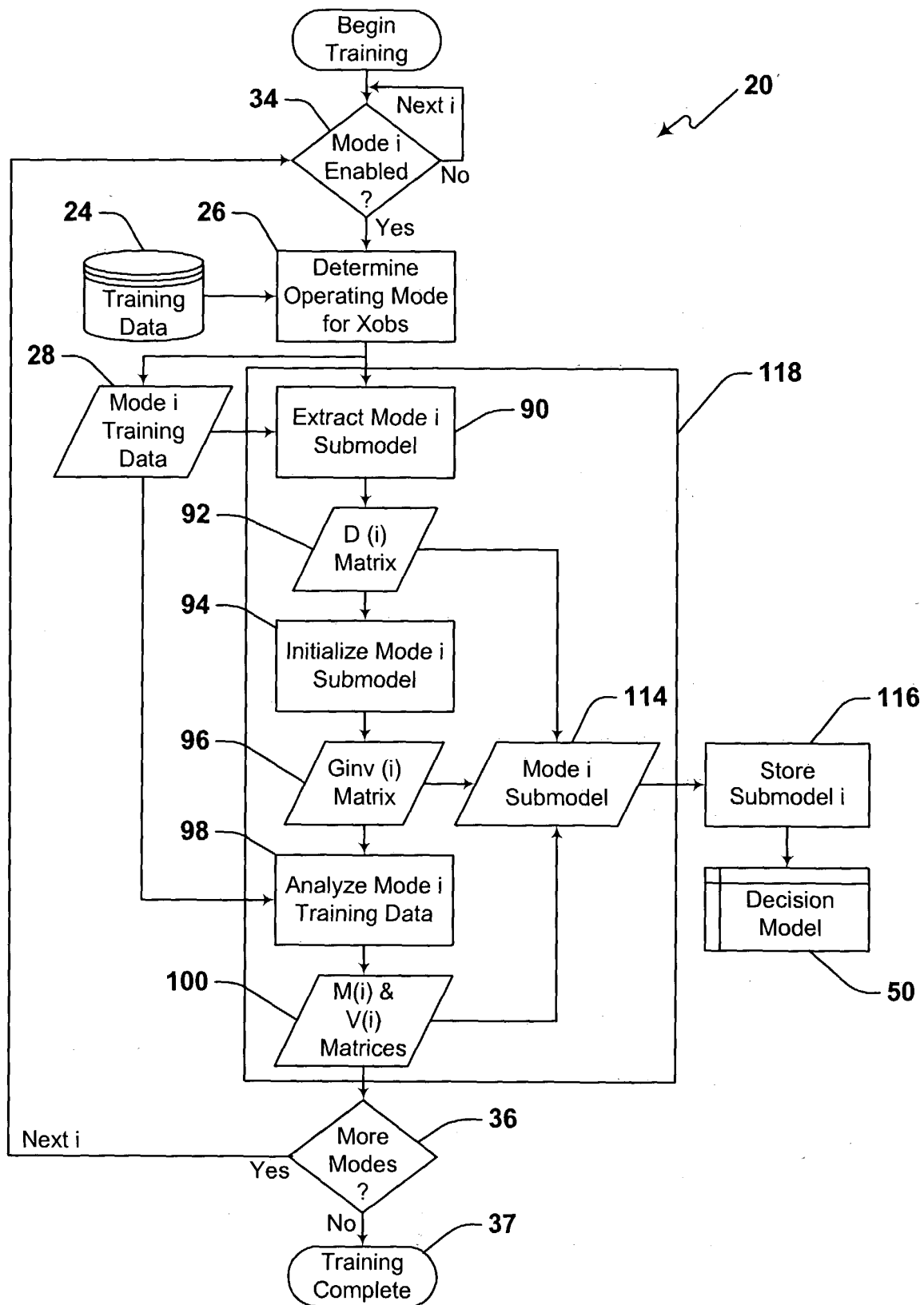


Figure 14

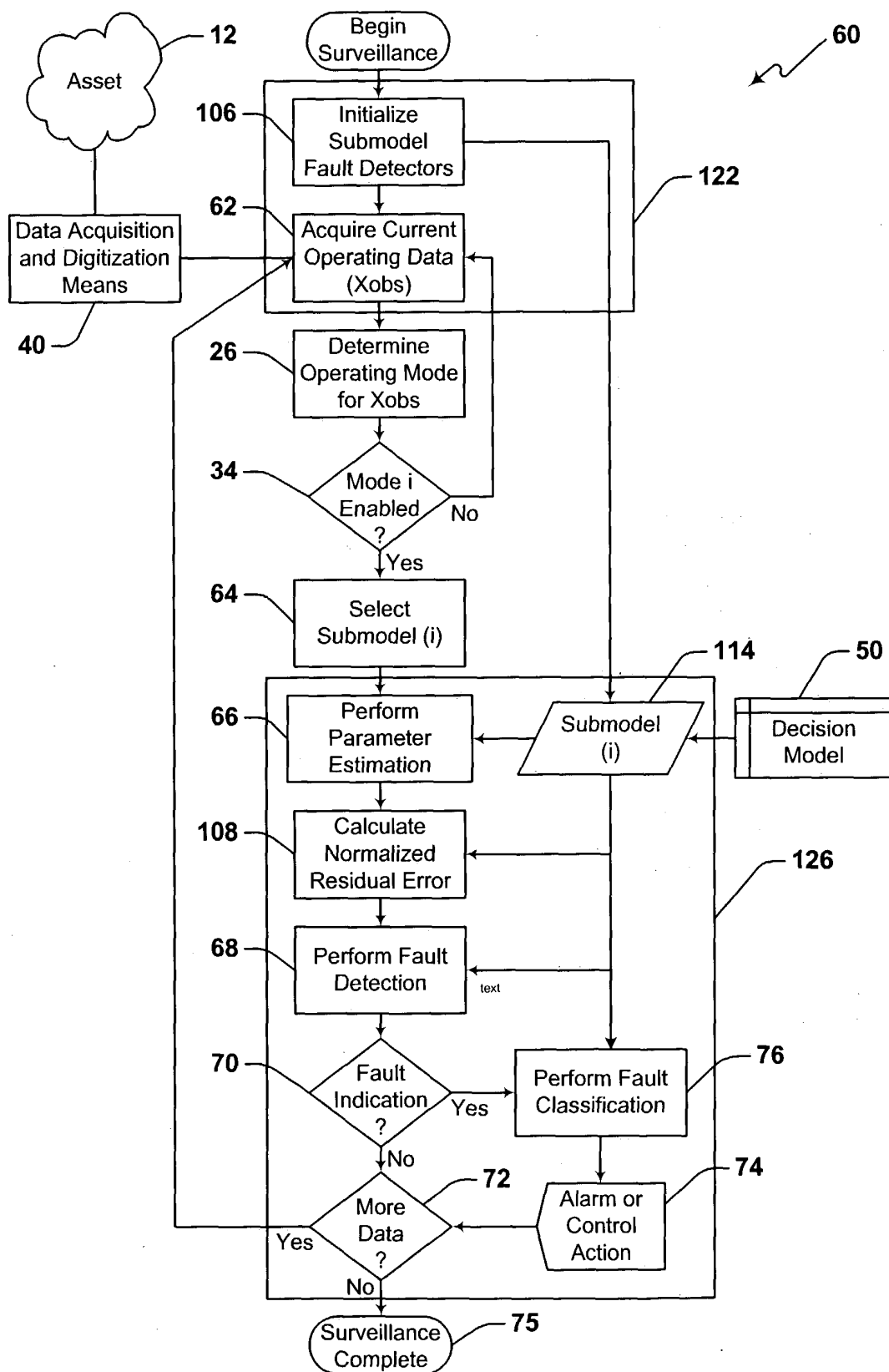


Figure 15

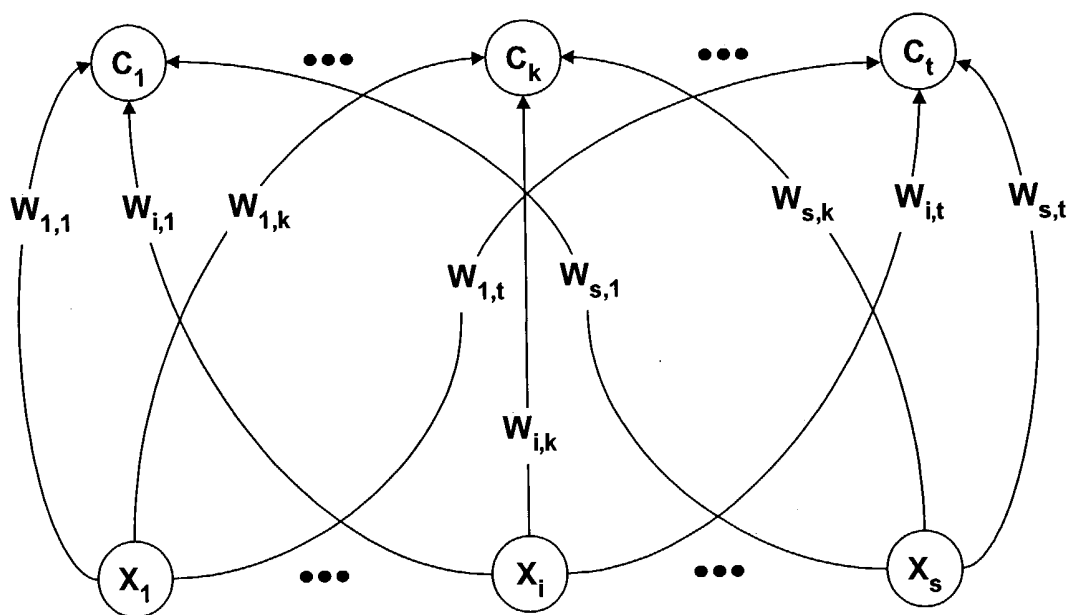


Figure 16

LVQ Neural Network Parameter	Design Value
Input Signals	MCC_PC_AVG (PC_CNTL_REF – MCC_PC_AVG) (Δ PC_CNTL_REF / Δ TIME)
Number of Classes	9 (one for each operating mode defined in Figure 21)
Number of Output Nodes per Class (N_{class})	8 (for each operating mode)
Learning Algorithm	LVQ2.1
Maximum Number of Epochs (n_{eps})	250
Initial Value of the Learning Rate (λ_0)	0.02
Window Size (ϵ)	0.5
Number of Training Vector Pairs (n_{LVQ})	500

Figure 17

SSME Signal Parameter ID	SSME Signal Parameter Name
PID40	OPOV_ACT_POS_A
PID42	FPOV_ACT_POS_A
PID52	HPFP_DS_P_A
PID58	FPB_PC_A
PID63	MCC_PC_AVG
PID90	HPOP_DS_P
PID100	FUEL_FLOW_AVG
PID105	HPFT_DS_T_A2
PID106	HPFT_DS_T_A3
PID107	HPFT_DS_T_B2
PID108	HPFT_DS_T_B3
PID200	MCC_PC_A_AVG
PID201	MCC_PC_B_AVG
PID205	HPOT_DS_T_A2
PID206	HPOT_DS_T_A3
PID207	HPOT_DS_T_B2
PID208	HPOT_DS_T_B3

Figure 18

Space Shuttle Flight ID	Engine Position
STS077	E2
STS078	E1
STS081	E3
STS082	E1
STS085	E1
STS085	E2
STS086	E2
STS087	E2
STS087	E3
STS090	E1

Figure 19

Model Description	Number of Signals	Modeled Operating Modes	Number of Process Mem Vectors	Parameter Estimation Method	Fault Detection Method
LVQ mode-partitioned (Model PD)	17 (defined in Figure 18)	Start01 Start12 Start24 SteadyFull SteadyLow Upthrust Downthrust	150 150 150 150 150 150 150	MSET	SPRT mean pos & neg
All-modes (Model A150)	17 (same)	All	150	MSET	SPRT mean pos & neg
All-modes (Model A300)	17 (same)	All	300	MSET	SPRT mean pos & neg

Figure 20

Mode Name	Operating Mode Criteria
PREFIRE	All observations preceding the vehicle start command to the engine. Considered a non-operating mode.
START01	Controller cycles 0 through 24 after receipt of the engine start command.
START12	Controller cycles 25 through 49 after receipt of the engine start command.
START24	Controller cycle 50 through detection of steady-state operation (typically at controller cycle ~110). The rule for transition to STEADY_FULL is: If in START24 and if $ PC_CNTL_REF - MCC_PC_AVG \leq (5 * 3.35)$, and $PC_CNTL_REF \geq 2500$ transition to STEADY_FULL
STEADY_FULL	STEADY_FULL is declared when either: 1) the last cycle's state was STEADY_FULL and the commanded PC is both unchanged and greater than 2500 psi, e.g., $ PC_CNTL_REF - LAST_PC_CNTL_REF < 3.35$ and $PC_CNTL_REF \geq 2500$; or 2) when the last cycle's state was a transient state and $ PC_CNTL_REF - MCC_PC_AVG \leq (5 * 3.35)$ and $PC_CNTL_REF \geq 2500$.
STEADY_LOW	STEADY_LOW is declared when either: 1) the last cycle's state was STEADY_LOW and the commanded PC is both unchanged and less than 2500 psi, e.g., $ PC_CNTL_REF - LAST_PC_CNTL_REF < 3.35$ and $PC_CNTL_REF < 2500$; or 2) when the last cycle's state was a transient state and $ PC_CNTL_REF - MCC_PC_AVG \leq (5 * 3.35)$ and $PC_CNTL_REF < 2500$.
UPTHRUST	UPTHRUST is declared when 1) the commanded PC has increased since the last cycle, and 2) $ PC_CNTL_REF - MCC_PC_AVG > (5 * 3.35)$
DOWNRHURST	DOWNRHURST is declared when 1) the commanded PC has decreased since the last cycle, and 2) $ PC_CNTL_REF - MCC_PC_AVG > (5 * 3.35)$
SHUTDOWN	All observations following the vehicle shutdown command to the engine. Considered a non-operating mode.

Figure 21

Test No.	Test Description	Sensor Failures	One Cycle Alarms	Total Avg Error %	Avg Cycle Time
PD-01	STS077E1. Nominal flight data.	0	2	0.408%	4.88 msec
PD-02	STS077E2. Nominal flight data.	0	0	0.217%	4.90 msec
PD-03	STS078E1. Nominal flight data.	0	0	0.352%	4.98 msec
PD-04	STS078E2. Nominal flight data.	0	1	0.296%	4.94 msec
PD-05	STS081E1. Nominal flight data.	0	2	0.400%	5.01 msec
PD-06	STS081E3. Nominal flight data.	0	0	0.281%	5.07 msec
PD-07	STS082E2. Nominal flight data.	0	1	0.286%	4.96 msec
PD-08	STS085E3. Nominal flight data.	0	0	0.282%	4.98 msec
PD-09	STS086E2. Nominal flight data.	0	0	0.254%	5.02 msec
PD-10	STS087E2. Nominal flight data.	0	0	0.246%	5.02 msec
Average for All Tests		0	1	0.302%	4.98 msec

Figure 22

T t No.	T st D scription	S nsor Failures	On Cycle Alarms	Tim to Detect	Error at Detect
PD-11	Drift PID40. 0.14 pct/sec beginning at 10.0 sec.	1 (PID40)	5	28.88 sec	5.8%
PD-12	Noise PID40. ±5 pct random beginning at 10.0 sec.	1 (PID40)	38	10.76 sec	N/A
PD-13	Drift PID42. 0.16 pct/sec beginning at 10.0 sec.	1 (PID42)	9	29.32 sec	5.9%
PD-14	Noise PID42. ±5 pct random beginning at 10.0 sec.	1 (PID42)	66	42.04 sec	N/A
PD-15	Drift PID52. 11.9 psi/sec beginning at 10.0 sec.	1 (PID52)	4	12.24 sec	2.4%
PD-16	Drift PID58. 10.2 psi/sec beginning at 10.0 sec.	1 (PID58)	5	9.44 sec	1.9%
PD-17	Drift PID90. 8.2 psi/sec beginning at 10.0 sec.	1 (PID90)	9	8.12 sec	1.6%
PD-18	Drift PID100. 31.9 gpm/sec beginning at 10.0 sec.	1 (PID100)	5	12.12 sec	2.4%
PD-19	Drift PID105. 3.4 degR/sec beginning at 10.0 sec.	1 (PID105)	11	16.16 sec	3.2%
PD-20	Drift PID200. 6.3 psi/sec beginning at 10.0 sec.	1 (PID200)	4	3.40 sec	0.7%
PD-21	Drift PID205. 2.7 degR/sec beginning at 10.0 sec.	1 (PID205)	4	18.28 sec	3.7%
<i>Average for All Drift Tests</i>				15.3 sec	3.1%

Figure 23

Test No.	Test Description	Sensor Failures	One Cycle Alarms	Total Avg Error %	Avg Cycle Time
A150-01	STS077E1. Nominal flight data.	0	0	0.556%	5.27 msec
A150-02	STS077E2. Nominal flight data.	0	9	0.458%	5.28 msec
A150-03	STS078E1. Nominal flight data.	0	0	0.593%	4.90 msec
A150-04	STS078E2. Nominal flight data.	0	0	0.396%	5.28 msec
A150-05	STS081E1. Nominal flight data.	0	0	0.685%	4.67 msec
A150-06	STS081E3. Nominal flight data.	0	0	0.480%	4.77 msec
A150-07	STS082E2. Nominal flight data.	1 (PID58) False Alarm	13	0.720%	5.28 msec
A150-08	STS085E3. Nominal flight data.	0	0	0.519%	4.73 msec
A150-09	STS086E2. Nominal flight data.	0	0	0.410%	4.77 msec
A150-10	STS087E2. Nominal flight data.	0	0	0.399%	5.22 msec
Average for All Tests		0	2	0.522%	5.02 msec

Figure 24. Comparative Results

Test No.	Test Description	S nsor Failures	One Cycl Alarms	Time to Detect	Error at Detect
A150-11	Drift PID40. 0.14 pct/sec beginning at 10.0 sec.	1 (PID40)	19	125.68 sec	25.1%
A150-12	Noise PID40. ±5 pct random beginning at 10.0 sec.	1 (PID40)	12	95.04 sec	N/A
A150-13	Drift PID42. 0.16 pct/sec beginning at 10.0 sec.	1 (PID42)	12	154.92 sec	31.0%
A150-14	Noise PID42. ±5 pct random beginning at 10.0 sec.	0 (Missed Alarm)	0	Missed Alarm	N/A
A150-15	Drift PID52. 11.9 psi/sec beginning at 10.0 sec.	1 (PID52)	4	27.40 sec	5.5%
A150-16	Drift PID58. 10.2 psi/sec beginning at 10.0 sec.	1 (PID58)	6	18.92 sec	3.8%
A150-17	Drift PID90. 8.2 psi/sec beginning at 10.0 sec.	1 (PID90)	4	60.32 sec	12.1%
A150-18	Drift PID100. 31.9 gpm/sec beginning at 10.0 sec.	2 (PID100) & (PID58 False Alarm)	23	43.24 sec	8.6%
A150-19	Drift PID105. 3.4 degR/sec beginning at 10.0 sec.	1 (PID105)	10	46.20 sec	9.2%
A150-20	Drift PID200. 6.3 psi/sec beginning at 10.0 sec.	1 (PID200)	4	22.72 sec	4.5%
A150-21	Drift PID205. 2.7 degR/sec beginning at 10.0 sec.	1 (PID205)	8	89.04 sec	17.8%
Average for All Drift Tests				65.4 sec	13.1%

Figure 25. Comparative Results

Test No.	Test Description	Sensor Failures	One Cycle Alarms	Total Avg Error %	Avg Cycle Time
A300-01	STS077E1. Nominal flight data.	0	0	0.488%	17.84 msec
A300-02	STS077E2. Nominal flight data.	0	0	0.379%	17.75 msec
A300-03	STS078E1. Nominal flight data.	0	0	0.424%	19.40 msec
A300-04	STS078E2. Nominal flight data.	0	0	0.359%	19.02 msec
A300-05	STS081E1. Nominal flight data.	0	0	0.633%	17.69 msec
A300-06	STS081E3. Nominal flight data.	0	0	0.501%	17.80 msec
A300-07	STS082E2. Nominal flight data.	0	0	0.620%	19.01 msec
A300-08	STS085E3. Nominal flight data.	0	2	0.521%	17.73 msec
A300-09	STS086E2. Nominal flight data.	0	1	0.340%	17.78 msec
A300-10	STS087E2. Nominal flight data.	0	0	0.319%	18.10 msec
Average for All Tests		0	0	0.458%	18.21 msec

Figure 26. Comparative Results

Test No.	Test Description	Sensor Failures	One Cycle Alarms ¹	Time to Detect	Error at Detect
A300-11	Drift PID40. 0.14 pct/sec beginning at 10.0 sec.	1 (PID40)	39	138.80 sec	27.8%
A300-12	Noise PID40. ±5 pct random beginning at 10.0 sec.	0 (Missed Alarm)	2	Missed Alarm	N/A
A300-13	Drift PID42. 0.16 pct/sec beginning at 10.0 sec.	1 (PID42)	26	139.08 sec	27.8%
A300-14	Noise PID42. ±5 pct random beginning at 10.0 sec.	0 (Missed Alarm)	2	Missed Alarm	N/A
A300-15	Drift PID52. 11.9 psi/sec beginning at 10.0 sec.	1 (PID52)	9	26.04 sec	5.2%
A300-16	Drift PID58. 10.2 psi/sec beginning at 10.0 sec.	1 (PID58)	8	16.92 sec	3.4%
A300-17	Drift PID90. 8.2 psi/sec beginning at 10.0 sec.	1 (PID90)	6	58.12 sec	11.6%
A300-18	Drift PID100. 31.9 gpm/sec beginning at 10.0 sec.	1 (PID100)	9	23.36 sec	4.7%
A300-19	Drift PID105. 3.4 degR/sec beginning at 10.0 sec.	1 (PID105)	6	28.32 sec	5.7%
A300-20	Drift PID200. 6.3 psi/sec beginning at 10.0 sec.	1 (PID200)	6	18.52 sec	3.7%
A300-21	Drift PID205. 2.7 degR/sec beginning at 10.0 sec.	1 (PID205)	12	64.32 sec	12.9%
Average for All Drift Tests				57.1 sec	11.4%

Figure 27. Comparative Results

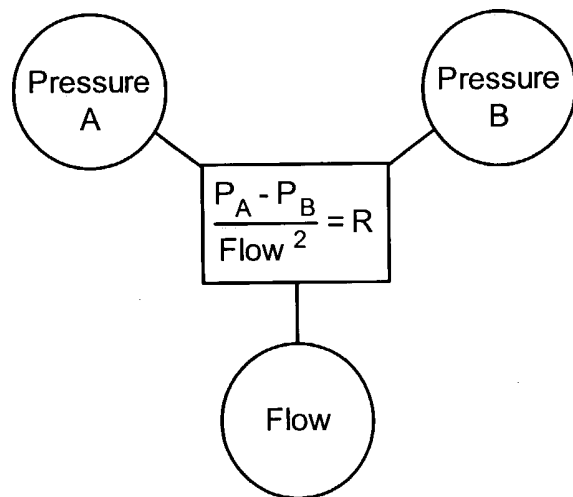


Figure 28

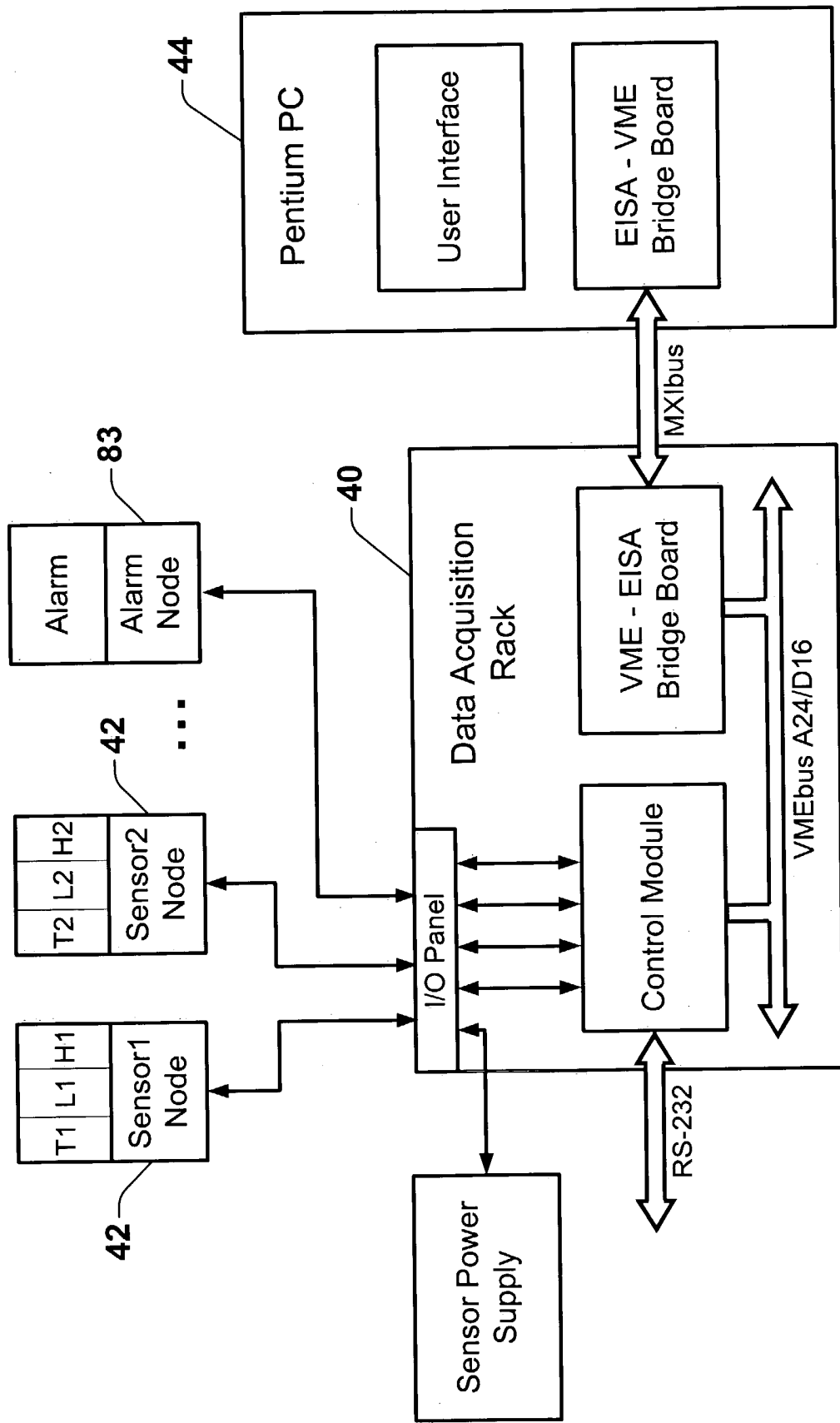


Figure 29

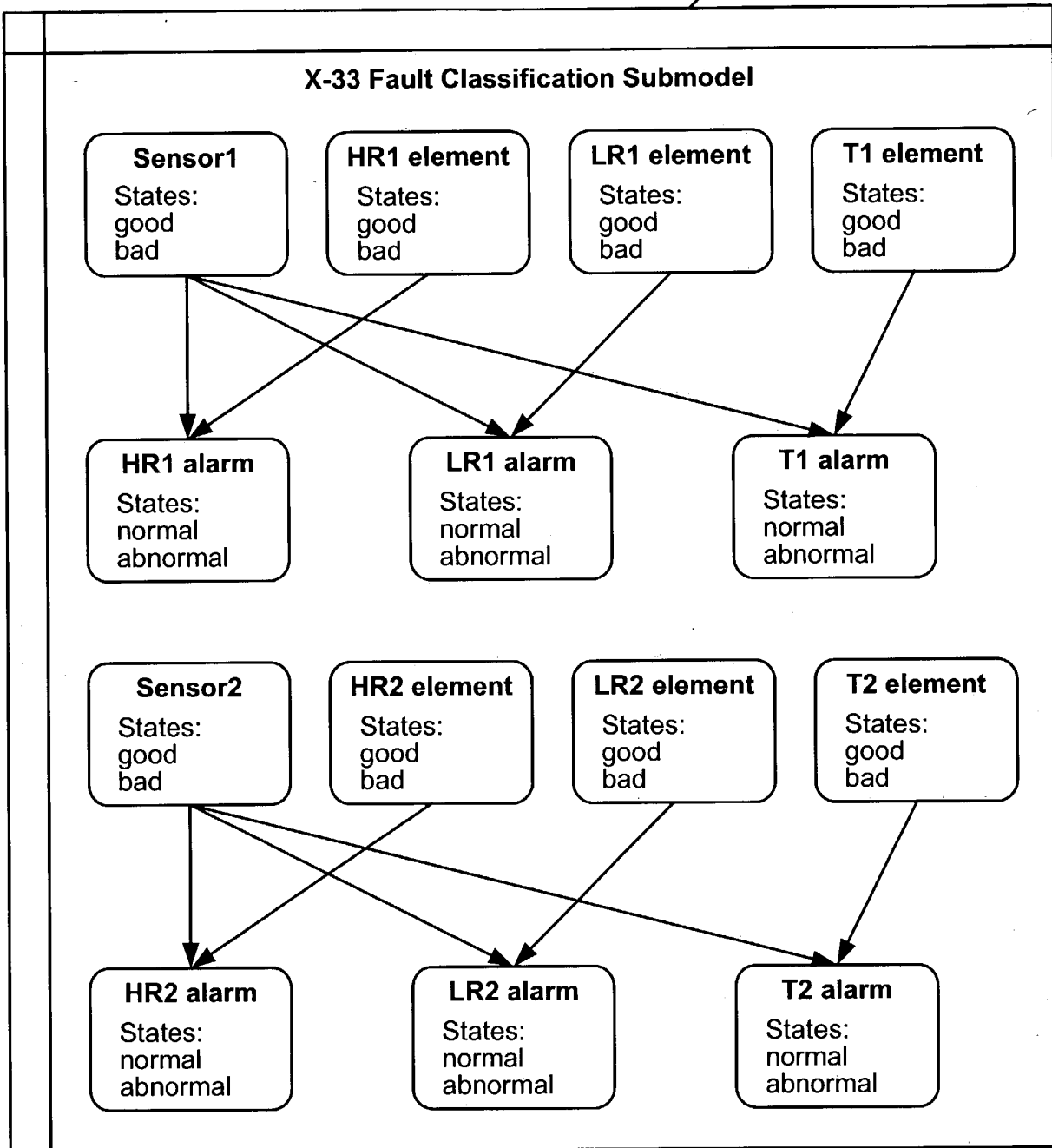


Figure 30

Node Name	States	Parents	Prior Probabilities	Threshold
Sensor1	good bad	none	$P(\text{good})=0.95, P(\text{bad})=0.05$	0.6
HR1 element	good bad	none	$P(\text{good})=0.9, P(\text{bad})=0.1$	0.6
LR1 element	good bad	none	$P(\text{good})=0.9, P(\text{bad})=0.1$	0.6
T1 element	good bad	none	$P(\text{good})=0.9, P(\text{bad})=0.1$	0.6
HR1 alarm	normal abnormal	HR1 element Sensor1	$P(\text{normal} \mid \text{HR1 element}=\text{good}, \text{Sensor1}=\text{good})=0.95$ $P(\text{abnormal} \mid \text{HR1 element}=\text{good}, \text{Sensor1}=\text{good})=0.05$ $P(\text{normal} \mid \text{HR1 element}=\text{good}, \text{Sensor1}=\text{bad})=0.05$ $P(\text{abnormal} \mid \text{HR1 element}=\text{good}, \text{Sensor1}=\text{bad})=0.95$ $P(\text{normal} \mid \text{HR1 element}=\text{bad}, \text{Sensor1}=\text{good})=0.05$ $P(\text{abnormal} \mid \text{HR1 element}=\text{bad}, \text{Sensor1}=\text{good})=0.95$ $P(\text{normal} \mid \text{HR1 element}=\text{bad}, \text{Sensor1}=\text{bad})=0.01$ $P(\text{abnormal} \mid \text{HR1 element}=\text{bad}, \text{Sensor1}=\text{bad})=0.99$	0.9
LR1 alarm	normal abnormal	LR1 element Sensor1	$P(\text{normal} \mid \text{LR1 element}=\text{good}, \text{Sensor1}=\text{good})=0.95$ $P(\text{abnormal} \mid \text{LR1 element}=\text{good}, \text{Sensor1}=\text{good})=0.05$ $P(\text{normal} \mid \text{LR1 element}=\text{good}, \text{Sensor1}=\text{bad})=0.05$ $P(\text{abnormal} \mid \text{LR1 element}=\text{good}, \text{Sensor1}=\text{bad})=0.95$ $P(\text{normal} \mid \text{LR1 element}=\text{bad}, \text{Sensor1}=\text{good})=0.05$ $P(\text{abnormal} \mid \text{LR1 element}=\text{bad}, \text{Sensor1}=\text{good})=0.95$ $P(\text{normal} \mid \text{LR1 element}=\text{bad}, \text{Sensor1}=\text{bad})=0.01$ $P(\text{abnormal} \mid \text{LR1 element}=\text{bad}, \text{Sensor1}=\text{bad})=0.99$	0.9
T1 alarm	normal abnormal	T1 element Sensor1	$P(\text{normal} \mid \text{T1 element}=\text{good}, \text{Sensor1}=\text{good})=0.95$ $P(\text{abnormal} \mid \text{T1 element}=\text{good}, \text{Sensor1}=\text{good})=0.05$ $P(\text{normal} \mid \text{T1 element}=\text{good}, \text{Sensor1}=\text{bad})=0.05$ $P(\text{abnormal} \mid \text{T1 element}=\text{good}, \text{Sensor1}=\text{bad})=0.95$ $P(\text{normal} \mid \text{T1 element}=\text{bad}, \text{Sensor1}=\text{good})=0.05$ $P(\text{abnormal} \mid \text{T1 element}=\text{bad}, \text{Sensor1}=\text{good})=0.95$ $P(\text{normal} \mid \text{T1 element}=\text{bad}, \text{Sensor1}=\text{bad})=0.01$ $P(\text{abnormal} \mid \text{T1 element}=\text{bad}, \text{Sensor1}=\text{bad})=0.99$	0.9

Figure 31

Node Name	States	Parents	Prior Probabilities	Threshold
Sensor2	good bad	none	$P(\text{good})=0.95, P(\text{bad})=0.05$	0.6
HR2 element	good bad	none	$P(\text{good})=0.9, P(\text{bad})=0.1$	0.6
LR2 element	good bad	none	$P(\text{good})=0.9, P(\text{bad})=0.1$	0.6
T2 element	good bad	none	$P(\text{good})=0.9, P(\text{bad})=0.1$	0.6
HR2 alarm	normal abnormal	HR2 element Sensor2	$P(\text{normal} \mid \text{HR2 element}=\text{good}, \text{Sensor2}=\text{good})=0.95$	0.9
			$P(\text{abnormal} \mid \text{HR2 element}=\text{good}, \text{Sensor2}=\text{good})=0.05$	
			$P(\text{normal} \mid \text{HR2 element}=\text{good}, \text{Sensor2}=\text{bad})=0.05$	
			$P(\text{abnormal} \mid \text{HR2 element}=\text{good}, \text{Sensor2}=\text{bad})=0.95$	
			$P(\text{normal} \mid \text{HR2 element}=\text{bad}, \text{Sensor2}=\text{good})=0.05$	
			$P(\text{abnormal} \mid \text{HR2 element}=\text{bad}, \text{Sensor2}=\text{good})=0.95$	
			$P(\text{normal} \mid \text{HR2 element}=\text{bad}, \text{Sensor2}=\text{bad})=0.01$	
			$P(\text{abnormal} \mid \text{HR2 element}=\text{bad}, \text{Sensor2}=\text{bad})=0.99$	
LR2 alarm	normal abnormal	LR2 element Sensor2	$P(\text{normal} \mid \text{LR2 element}=\text{good}, \text{Sensor2}=\text{good})=0.95$	0.9
			$P(\text{abnormal} \mid \text{LR2 element}=\text{good}, \text{Sensor2}=\text{good})=0.05$	
			$P(\text{normal} \mid \text{LR2 element}=\text{good}, \text{Sensor2}=\text{bad})=0.05$	
			$P(\text{abnormal} \mid \text{LR2 element}=\text{good}, \text{Sensor2}=\text{bad})=0.95$	
			$P(\text{normal} \mid \text{LR2 element}=\text{bad}, \text{Sensor2}=\text{good})=0.05$	
			$P(\text{abnormal} \mid \text{LR2 element}=\text{bad}, \text{Sensor2}=\text{good})=0.95$	
			$P(\text{normal} \mid \text{LR2 element}=\text{bad}, \text{Sensor2}=\text{bad})=0.01$	
			$P(\text{abnormal} \mid \text{LR2 element}=\text{bad}, \text{Sensor2}=\text{bad})=0.99$	
T2 alarm	normal abnormal	T2 element Sensor2	$P(\text{normal} \mid \text{T2 element}=\text{good}, \text{Sensor2}=\text{good})=0.95$	0.9
			$P(\text{abnormal} \mid \text{T2 element}=\text{good}, \text{Sensor2}=\text{good})=0.05$	
			$P(\text{normal} \mid \text{T2 element}=\text{good}, \text{Sensor2}=\text{bad})=0.05$	
			$P(\text{abnormal} \mid \text{T2 element}=\text{good}, \text{Sensor2}=\text{bad})=0.95$	
			$P(\text{normal} \mid \text{T2 element}=\text{bad}, \text{Sensor2}=\text{good})=0.05$	
			$P(\text{abnormal} \mid \text{T2 element}=\text{bad}, \text{Sensor2}=\text{good})=0.95$	
			$P(\text{normal} \mid \text{T2 element}=\text{bad}, \text{Sensor2}=\text{bad})=0.01$	
			$P(\text{abnormal} \mid \text{T2 element}=\text{bad}, \text{Sensor2}=\text{bad})=0.99$	

Figure 32

Partitioned Model Under OPERATING Conditions		
Fault Simulated	Fault Classified	Fault Classification Probabilities
H1 Drift High	H1 Element Fault	$P(\text{H1 Element} = \text{ABNORMAL}) = 0.6779$ $P(\text{L1 Element} = \text{ABNORMAL}) = 0.0058$ $P(\text{T1 Element} = \text{ABNORMAL}) = 0.0058$ $P(\text{Sensor1} = \text{ABNORMAL}) = 0.0010$
L1 Drift High	L1 Element Fault	$P(\text{L1 Element} = \text{ABNORMAL}) = 0.6779$ $P(\text{H1 Element} = \text{ABNORMAL}) = 0.0058$ $P(\text{T1 Element} = \text{ABNORMAL}) = 0.0058$ $P(\text{Sensor1} = \text{ABNORMAL}) = 0.0010$
T1 Drift High	T1 Element Fault	$P(\text{T1 Element} = \text{ABNORMAL}) = 0.6779$ $P(\text{H1 Element} = \text{ABNORMAL}) = 0.0058$ $P(\text{L1 Element} = \text{ABNORMAL}) = 0.0058$ $P(\text{Sensor1} = \text{ABNORMAL}) = 0.0010$
H1 & L1 Drift High	H1 Element Fault L1 Element Fault	$P(\text{H1 Element} = \text{ABNORMAL}) = 0.6121$ $P(\text{L1 Element} = \text{ABNORMAL}) = 0.6121$ $P(\text{Sensor1} = \text{ABNORMAL}) = 0.1156$ $P(\text{T1 Element} = \text{ABNORMAL}) = 0.0077$
H1, L1 & T1 Drift High	Sensor1 Fault	$P(\text{Sensor1} = \text{ABNORMAL}) = 0.9433$ $P(\text{H1 Element} = \text{ABNORMAL}) = 0.1363$ $P(\text{L1 Element} = \text{ABNORMAL}) = 0.1363$ $P(\text{T1 Element} = \text{ABNORMAL}) = 0.1363$

Figure 33

Partitioned Model Under VENTING Conditions		
Fault Simulated	Fault Classified	Fault Classification Probabilities
H1 Drift High	H1 Element Fault	$P(\text{H1 Element} = \text{ABNORMAL}) = 0.6779$ $P(\text{L1 Element} = \text{ABNORMAL}) = 0.0058$ $P(\text{T1 Element} = \text{ABNORMAL}) = 0.0058$ $P(\text{Sensor1} = \text{ABNORMAL}) = 0.0010$
L1 Drift High	L1 Element Fault	$P(\text{L1 Element} = \text{ABNORMAL}) = 0.6779$ $P(\text{H1 Element} = \text{ABNORMAL}) = 0.0058$ $P(\text{T1 Element} = \text{ABNORMAL}) = 0.0058$ $P(\text{Sensor1} = \text{ABNORMAL}) = 0.0010$
T1 Drift High	T1 Element Fault	$P(\text{T1 Element} = \text{ABNORMAL}) = 0.6779$ $P(\text{H1 Element} = \text{ABNORMAL}) = 0.0058$ $P(\text{L1 Element} = \text{ABNORMAL}) = 0.0058$ $P(\text{Sensor1} = \text{ABNORMAL}) = 0.0010$
H1 & L1 Drift High	H1 Element Fault L1 Element Fault	$P(\text{H1 Element} = \text{ABNORMAL}) = 0.6121$ $P(\text{L1 Element} = \text{ABNORMAL}) = 0.6121$ $P(\text{Sensor1} = \text{ABNORMAL}) = 0.1156$ $P(\text{T1 Element} = \text{ABNORMAL}) = 0.0077$
H1, L1 & T1 Drift High	Sensor1 Fault	$P(\text{Sensor1} = \text{ABNORMAL}) = 0.9433$ $P(\text{H1 Element} = \text{ABNORMAL}) = 0.1363$ $P(\text{L1 Element} = \text{ABNORMAL}) = 0.1363$ $P(\text{T1 Element} = \text{ABNORMAL}) = 0.1363$

Figure 34

Unpartitioned Model Under OPERATING Conditions		
Fault Simulated	Fault Classified	Fault Classification Probabilities
H1 Drift High	H1 Element Fault	P(H1 Element = ABNORMAL)= 0.6779 P(L1 Element = ABNORMAL)= 0.0058 P(T1 Element = ABNORMAL)= 0.0058 P(Sensor1= ABNORMAL)= 0.0010
L1 Drift High	L1 Element Fault	P(L1 Element = ABNORMAL)= 0.6779 P(H1 Element = ABNORMAL)= 0.0058 P(T1 Element = ABNORMAL)= 0.0058 P(Sensor1= ABNORMAL)= 0.0010
T1 Drift High	T1 Element Fault	P(T1 Element = ABNORMAL)= 0.6779 P(H1 Element = ABNORMAL)= 0.0058 P(L1 Element = ABNORMAL)= 0.0058 P(Sensor1= ABNORMAL)= 0.0010
H1 & L1 Drift High	H1 Element Fault L1 Element Fault	P(H1 Element = ABNORMAL)= 0.6121 P(L1 Element = ABNORMAL)= 0.6121 P(Sensor1= ABNORMAL)= 0.1156 P(T1 Element = ABNORMAL)= 0.0077
H1, L1 & T1 Drift High	Sensor1 Fault	P(Sensor1= ABNORMAL)= 0.9433 P(H1 Element = ABNORMAL)= 0.1363 P(L1 Element = ABNORMAL)= 0.1363 P(T1 Element = ABNORMAL)= 0.1363

Figure 35 Comparative Results

Unpartitioned Model Under VENTING Conditions		
Fault Simulated	Fault Classified	Fault Classification Probabilities
H1 Drift High	H1 Element Fault	P(H1 Element = ABNORMAL)= 0.6779 P(L1 Element = ABNORMAL)= 0.0058 P(T1 Element = ABNORMAL)= 0.0058 P(Sensor1= ABNORMAL)= 0.0010
L1 Drift High	<i>Not Detected</i>	P(L1 Element = ABNORMAL)= 0.1000 P(H1 Element = ABNORMAL)= 0.1000 P(T1 Element = ABNORMAL)= 0.1000 P(Sensor1= ABNORMAL)= 0.0500
T1 Drift High	T1 Element Fault	P(T1 Element = ABNORMAL)= 0.6779 P(H1 Element = ABNORMAL)= 0.0058 P(L1 Element = ABNORMAL)= 0.0058 P(Sensor1= ABNORMAL)= 0.0010
H1 & L1 Drift High	H1 Element Fault (L1 Fault Not Detected)	P(H1 Element = ABNORMAL)= 0.6779 P(L1 Element = ABNORMAL)= 0.0058 P(T1 Element = ABNORMAL)= 0.0058 P(Sensor1= ABNORMAL)= 0.0010
H1, L1 & T1 Drift High	H1 Element Fault T1 Element Fault (L1 Fault Not Detected)	P(H1 Element = ABNORMAL)= 0.6121 P(T1 Element = ABNORMAL)= 0.6121 P(Sensor1= ABNORMAL)= 0.1156 P(L1 Element = ABNORMAL)= 0.0077

Figure 36 Comparative Results